The BNL Smarter Grid Research Strategy: Plans and Status

Brookhaven National Laboratory

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a passion for discovery

Office of Science
U.S. DEPARTMENT OF ENERGY

Building the Smarter Grid R&D Vision

- The heart of BNL's approach to grid R&D for a Smarter Grid is begins with a geospatially referenced model with access to historical and real time data and measurements.

- Next, as a federal enclave, BNL has the ability to perform certain experiments and test new equipment on its grid prior to commercial introduction.

- We seek to give deeper insight into issues such as:
  - Renewable integration and penetration
  - Distribution efficiency and reliability
  - The role of micro-grids and related concepts, such as islanding, in the smarter grid world.

- BNL is creating a trusted "real world" simulation research laboratory and constructing a research test bed as a basis for future collaborative R&D effort.

Brookhaven Energy R&D: A Collaborative Approach
Basic Research, Applied Research, and Industry Working Together

BNL Resources

CFN/Nanoscience

NSLS/NSLS-II

ISB-I

BNL Research

LISF

New York Blue

NY State Consortia/Resources

ENERGY CHALLENGES: New York and Beyond

Electric Systems

Sustainable Fuels

DOE ALIGNMENT/LEVERAGE

DOE Priority Research Directions
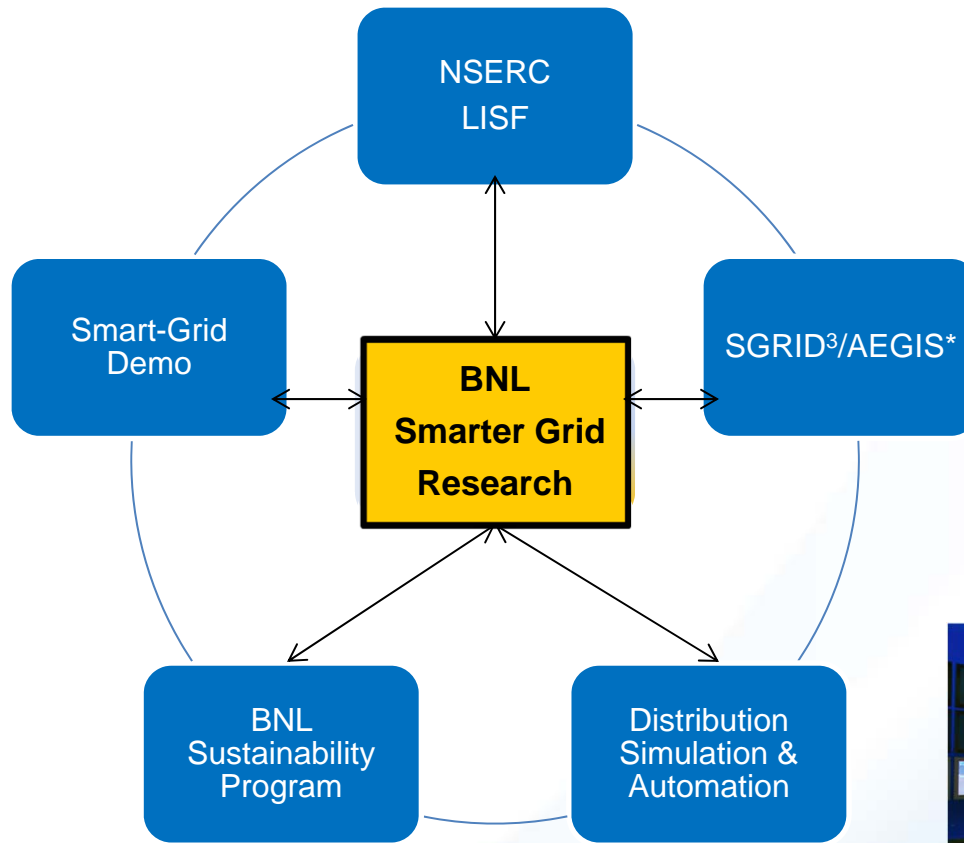
4 Energy Frontier Research Centers

Collaborators/Joint Appointments

Most importantly for today, we are developing research collaborations with NY – and hopefully – other regional utilities

- Integrated system modeling approaches with Orange and Rockland (ORU) and Central Hudson (CHGE)

- Cost benefit analysis with ORU

- Supercomputer implementation of planning models with LIPA

- Storm and outage management discussions with LIPA and ORU

- Probabilistic Risk Assessment for Dynamic Asset Risk Management with LIPA (workshop in November)

- Analysis of east end distribution system with LIPA (notional stage)

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BNL's Vision for a
Smarter Grid Test Bed & Simulation Lab

NSERC LISF

SGRID³/AEGIS*

Smart-Grid Demo

BNL Smarter Grid Research

BNL Sustainability Program

Distribution Simulation & Automation

Brookhaven Science Associates

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BNL is host to a 32MW Solar Farm – largest solar east of the Mississippi River -- offering massive data for you at our simulation R&D lab or at your R&D site

LISF Solar Energy Research

- **32 MW-ac grid-connected PV plant**
  - Owned by Long Island Solar Farm, LLC (company partially owned by BP Solar)
  - Purpose-sell power to LIPA under a PPA
  - Commercial operation began Nov. 1, 2011

- **BNL is collecting data from LISF**
  - Unique high-speed, time-resolved data sets (solar resource + power quality)
  - Characterize variability of utility-scale plants in the northeast
  - Investigate the impacts of utility-scale renewable energy generation on the grid

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BNL is constructing the Northeast Solar Energy Research Center (NSERC) with flexible design for your R&D experiments and tests

NSERC Solar Energy Research Facility

- Solar PV Research Array - 1MW-ac
  - Connected to BNL electrical system
  - Reconfigurable for different test scenarios
  - Capability for storage
  - Conceptual design complete
  - Construction to begin early 2013
  - Operation expected summer 2013

- Research Enabled
  - Renewables integration
  - Role of innovative inverter controls (DVAR, voltage regulation)
  - Role of storage

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BNL is evaluating smart sensors in the campus electrical network to enable using the site as a microgrid test bed with options for utilities to test on their grids

**Smarter Micro-Grid (SMG) Demonstration Project**

- BNL has a 20 MW base load representative of a typical industrial complex; 13.8 kV primary distribution

- An active collaboration is in place for placing a network of new generation grid sensors in the BNL distribution system

- NSERC includes renewable generation on the BNL grid, which enables the creation of a micro-grid test bed.

- BNL has received the first shipment of sensors and is initiating a pre-installation test program at BNL and a local utility (ORU)

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Smarter Electric Grid Research, Innovation, Development. Demonstration, Deployment Center (SGRID³) at BNL/SBU

With the vision of model-forward, SGRID³ will provide the facility and focus on the Northeast electric grid with modeling and simulation using actual power systems in real time operation

- Integrated System Models
- Historical and real time data and measurements
- Geographically-based information
- Component Models
- Simulations of natural and unnatural events
- Developing and testing advanced micro-grid management strategies

ISAT GeoStar 45
23:15 EST 14 Aug. 2003
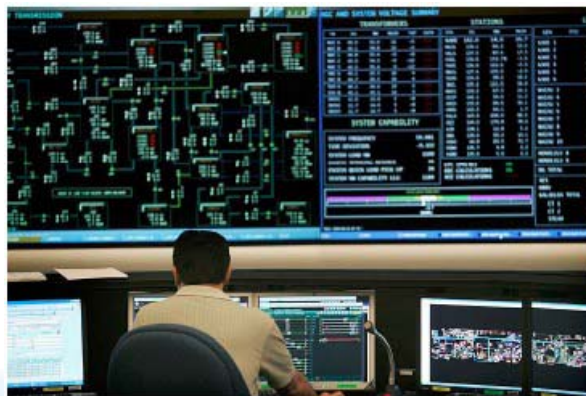
Initial funding from Empire State Development Corporation

SGRID³ via its Advanced Electrical Grid Innovation and Support (AEGIS) Center will facilitate the development of new capabilities to allow utilities to monitor and model their grids in real time – a capability that currently does not exist.

• Develop knowledge that will guide future utility investments in the electrical transmission and distribution systems in the Northeast.
• Provide computing capability for grid studies with simulation focused on natural and unnatural events

In short …

- BNL is building an asset base to support the work of utilities and advance the state of tools and technology for the state and the region for a smarter grid.